$$\lambda = 2\pi h\left[\frac{(1-v_s^2)E_f}{(1-v_f^2)E_s}\right]^{1/3} \quad (3)$$

where E, v, h, and ϵ represent respectively modulus, Poisson ratio, overlay thickness, and compressive strain, and the subscripts s and f denotes substrate **16** and overlay **18**.

[0047] Where the wavelength falls within the visible spectrum, it is appreciated that a structural color will result throughout the surface **14**. That is to say the wrinkles **12** will cause a color to be perceived by altering the way light travels at different dimensions, as opposed to chemical colors that rely upon the absorption of certain wavelength lights by pigment molecules. It is appreciated that the colors are highly angle dependent; that is to say, the viewing angle contributes to the actual color perceived.

[0048] The substrate **16** may be rectangular (FIGS. **2-7**), oblong, define a molding, such as an auto trim, or be of any shape, so long as it is large enough to support a surface **14** suitable for displaying the intended wrinkles **12**. The substrate **16** may include other components such as an external interface layer (not shown) that facilitates bonding with the overlay **18**, or non-active sectors where wrinkles **12** are not desired, for example, to better withstand purely compressive forces.

[0049] Moreover, it is appreciated that in each embodiment, the system **10** may be configured such that mechanical deformation effects a modification of the amplitude and wavelength of pre-existing wrinkles **12**, so as to vary the surface texture; for example, to reduce veiling glare, it may be sufficient to modulate only in a small range of amplitudes and/or wavelengths to create a meaningful or sufficient change in reflectance, as the modification is (in this particular case) non-linear. Finally, it is appreciated that complex wrinkling patterns may be created by varying the overlay **18** thickness across the substrate **16**, or by applying multi-axial (FIGS. **1** and **3**), or radial (FIG. **4***a*) loading conditions and similarly modulating.

[0050] As shown in FIG. **2**, the preferred system **10** further includes a power supply **22** communicatively coupled to the actuator **20**, and operable to generate a sufficient activation signal on-demand. In an automotive application, for example, the power supply **22** may include the charging system of the vehicle (not shown). Here, an electronic controller **24** is preferably employed intermediate the supply **22** and actuator **20**, and programmably equipped to control actuation. That is to say, the timing, duration, and magnitude of a surface texturing event may be controlled by manipulating the signal accordingly. Lastly, a sensor **26** may be used to provide input (e.g., notice of a triggering event) to the controller **24**. In this configuration, the system **10** is operable to provide autonomous texturing, in addition to or lieu of on-demand texturing, when the controller **24** receives the input. For example, a thermometer **26** may be employed to effect active texturing of a steering wheel surface (not shown), when the interior cabin temperature reaches a threshold temperature; or, a photoelectric sensor **26** may be used to actively modify the texture of a dashboard during daylight hours to reduce veiling glare. Similar automation with respect to wind drag and exterior surface texture may also be achieved by the present invention.

[0051] In an exemplary embodiment, the substrate **16** consisted essentially of urethane elastomer having a Hardness of Shore 00=40, and the overlay **18** was presented by a mylar film with a thickness of 0.00127 cm. Lateral wrinkles **12** were produced under a uniaxial pre-strain (FIG. **1**) and complex wrinkles **12** under biaxial pre-strain (FIG. **2**). In another example, the overlay **18** was formed by curing a thin film of urethane adhesive on a uniaxially pre-strained (approximately 10%) surface. The latter embodiment created a constant bed of wrinkles **12** having a wavelength of approximately 250 μm and an amplitude of approximately 100 μm. As previously presented, the substrate **16** may also be coated at room temperature with a "white gold" overlay (e.g., palladium/gold alloy composition) **18** using a sputtering system (not shown). Here, the overlay thickness (e.g., approximately 10 nm) is controlled by deposition time and may be measured directly by a scanning electron microscopic analysis of the cross-sections.

[0052] It is appreciated that the substrate **16** may be formed of SMP presenting a normal elastic modulus greater than that of the overlay **18**, so as to be able to lock in the pre-strain therein. In this configuration, where actuation (i.e., wrinkle formation) is desired, the SMP substrate is first activated to its higher temperature state, which presents a lower modulus than that of the overlay **18**.

[0053] To effect wrinkling, the actuator **20** is drivenly coupled to the substrate **16**, and more preferably through opposite end caps **28**. The end caps **28** preferably coextend with a lateral edge of the substrate **16** (FIGS. **4-6**), so that the actuating force is transferred evenly across the substrate **16**. The end caps **28** are fixedly secured relative to the substrate **16** and may be anchored therein via over-molded engaging prongs/hooks (not shown) or other fastening methods. In a first embodiment, the actuator **20** includes at least one shape memory wire/tendon formed for example of SMA, EAP, etc. that is embedded within, so as to traverse the full width of the substrate **16** FIGS. **1-5**. More preferably, a single wire **20** may be entrained by the end caps **28**, so as to form multiple loops along the length of the substrate. The wire **20** is preferably activated so as to promote uniform activation along its length, and thereby cause the caps **28** to travel towards each other without rotation. Where thermally activated, it is appreciated that the substrate **16** must be able to withstand the necessary heating-cooling cycle of the actuator **20**.

[0054] To effect multi-axial loading and complex wrinkle formation (FIG. **3**), it is appreciated that plural wires **20** may traverse the substrate **16** at intercepting orientations. In FIG. **3**, a plurality of wires **20** intercept each other in an orthogonal manner, so as to define a mesh or grid. In this configuration, the actuator **20** is configured to effect biaxial loading. Other more complex multi-axial loading configurations may be used, including a wire pattern consisting of radially extending wires **20** that intercept at the center of the substrate **16**. In this configuration, the substrate **16** preferably defines a disk; and the resultant wrinkles **12** form concentric rings (FIG. **4***a*).

[0055] In another embodiment, the actuator **20** is externally coupled to, and configured to retentively displace at least one cap **28** (FIG. **5**). To produce wrinkles **12** or increase the amplitude and reduce the wavelengths of existing wrinkles **12** upon the surface **14**, the actuator **20** acts to push the cap **28** towards the midline of the substrate **16**. Suitable active material actuators for use in this regard include a piezoelectric stack sandwiched between the end cap **28** and fixed structure that expands when activated to push. An arcuate SMA or EAP element **20** (FIG. **7**) that straightens when activated may be used to compress the substrate **16**. Finally, an SMP or SMA